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**Foot and leg protectors —  
Requirements and test methods for  
footwear components —**

**Part 4:  
Non-metallic perforation resistant  
inserts**

iTeh STANDARD PREVIEW

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*Protecteurs du pied et de la jambe — Exigences et méthodes d'essais  
pour les composants de chaussure —*

*Partie 4: Inserts anti-perforation non métalliques*

<https://standards.iteh.ai/catalog/standards/sist/b04447ca-1e25-4211-b433-533498f26451/iso-22568-4-2021>



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CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 3, *Foot protection*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 161, *Foot and leg protectors*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 22568-4:2019), which has been technically revised

The main changes are as follows:

- [Table 2](#), changes in the type names from X and Y to PL and PS, new requirements (“tent effect” and minimum value of 950 N);
- new nail, see [Figure B.1](#) (conical shape instead of pyramidal);
- new definition in [3.2](#);
- [Figure B.3](#) new dimension of the nail;
- Annex C and the reference material have been deleted.

A list of all parts in the ISO 22568 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

ISO 20345, ISO 20346 and ISO 20347 are related to safety, protective and occupational footwear which define the performance and required properties of the footwear. On introducing these standards all national standards relating to perforation resistant inserts were withdrawn leaving the manufacturers of these items with no means of demonstrating the performance of their products. This document has been prepared to allow manufacturers to demonstrate the type of the perforation resistant inserts before being inserted into the footwear.

Non-metallic perforation resistant inserts and materials complying with the requirements of this document are suitable components of “PPE footwear”.

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# Foot and leg protectors — Requirements and test methods for footwear components —

## Part 4: Non-metallic perforation resistant inserts

### 1 Scope

This document specifies requirements and test methods for the non-metallic inserts with resistance against mechanical perforation, intended to function as components of PPE footwear (e.g. as described by ISO 20345, ISO 20346 and ISO 20347).

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 105-E04:2013, *Textiles — Tests for colour fastness — Part E04: Colour fastness to perspiration*

ISO 20344, *Personal protective equipment — Test methods for footwear*

ISO 20345, *Personal protective equipment — Safety footwear*

ISO 20346, *Personal protective equipment — Protective footwear*

ISO 20347, *Personal protective equipment — Occupational footwear*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20345, ISO 20346 and ISO 20347 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

#### 3.1

##### **non-metallic perforation resistant insert**

non-metallic footwear component placed (or intended to be placed) in the sole complex or used as an insole simultaneously in order to provide protection against perforation

#### 3.2

##### **“tent effect”**

separation between the layers of the test piece during the testing procedure, some layers are perforated other not giving, the aspect of the tent to the test piece

Note 1 to entry: The procedure is given in [Annex A](#).

## 4 Requirements for non-metallic perforation resistant inserts

### 4.1 General

Depending on the footwear construction, the non-metallic perforation resistant inserts could be in contact with the wearer foot, therefore the requirements of ISO 20345, ISO 20346 and ISO 20347 should be taken into account (for example abrasion resistance, water absorption, innocuousness).

Perforation resistant material can be tested in accordance with this document, even in an unshaped status, if it is intended to be cut and/or shaped by the footwear or sole manufacturer. When shaped non-metallic perforation resistant inserts are tested in accordance with this document, their suitability to fit into footwear is not assured, because the dimensional conformity to the footwear depends on the individual shape of each model of footwear.

**Table 1 — Summary of requirements and number of samples**

| Property   | Subclause           | Number of samples  | Status    |
|--|---------------------|--|-----------|
| Resistance to perforation  | <a href="#">4.2</a> | Non-metallic material: 1 sample<br>or<br>Ready -shaped inserts: 1 sample   | mandatory |
| Flexing resistance   | <a href="#">4.3</a> | Non-metallic material: 1 sample<br>or<br>Ready - shaped inserts: 2 different sizes                               | mandatory |
| Stability against ageing and environmental influence               | <a href="#">4.4</a> | Non-metallic material: 2 samples for each treatment<br>or<br>Ready -shaped inserts: 2 samples for each treatment | mandatory |
| Electrical resistance  | <a href="#">4.5</a> | Non-metallic material: 1 sample  | optional  |
| NOTE For details, see <a href="#">4.2</a> to <a href="#">4.5</a> . |                     |  |           |

For each of the required measurements performed in accordance with this standard, a corresponding estimate of the uncertainty of measurement should be evaluated. One of the following approaches shall be used:

- a statistical method, e.g. that given in ISO 5725-2[2];
- a mathematical method, e.g. that given in ISO/IEC Guide 98-3[4];
- uncertainty and conformity assessment as given in ISO/IEC Guide 98-4[5];
- JCGM 100[6].

### 4.2 Resistance to perforation

When the non-metallic perforation resistant inserts are tested in accordance with the applicable methods described in [5.1](#), they shall meet one of the two types given in [Table 2](#).



**Table 2 — Minimum requirements for the perforation force**

| Types   | Test method               | Requirements   |
|---------|---------------------------|--|
| Type PL | See <a href="#">5.1.1</a> | Perforation test (see <a href="#">A.4</a> ); the four results reported shall be “pass” with a force of 1100 N<br>No “tent effect” shall occur            |
| Type PS | See <a href="#">5.1.2</a> | Perforation force ( <a href="#">B.4</a> )<br>the average value reported shall be greater or equal to 1100 N<br>No single value shall be lower than 950 N |

NOTE This property has two types in term of the protection afforded. This covers the degree of risk or hazard that a user will face in terms of the type of working places. Type PS offers more appropriate protection from smaller diameter and sharper objects than type PL.

### 4.3 Flexing resistance

When tested in accordance with the method described in [5.2](#), the non-metallic perforation resistant insert shall exhibit no visible signs of cracking, disintegration or delamination after having been subjected to  $1 \times 10^6$  (one million) flexion cycles.

### 4.4 Stability against ageing and environmental influence

When subjected to each single one of the 4 treatments described in [5.3](#) and tested in accordance with the method described in [5.1](#), the non-metallic perforation resistant insert shall conform to the requirements of [4.2](#).

### 4.5 Electrical resistance (standards.iteh.ai)

This property is optional and frequently requested when the non-metallic perforation resistant inserts are supposed to be used in a footwear with electrical properties (ISO 20345:2021, 6.2.2.1 and 6.2.2.2).

The results of this test, see [5.4](#), is given as an information, this document does not fix requirements.

## 5 Test methods for the non-metallic perforation tests

### 5.1 Determination of perforation resistance

#### 5.1.1 Method PL: with conical nail 4,5 mm diameter

The test method described in [Annex A](#) shall be used.

#### 5.1.2 Method PS: with conical nail 3,0 mm diameter

The test method described in [Annex B](#) shall be used.

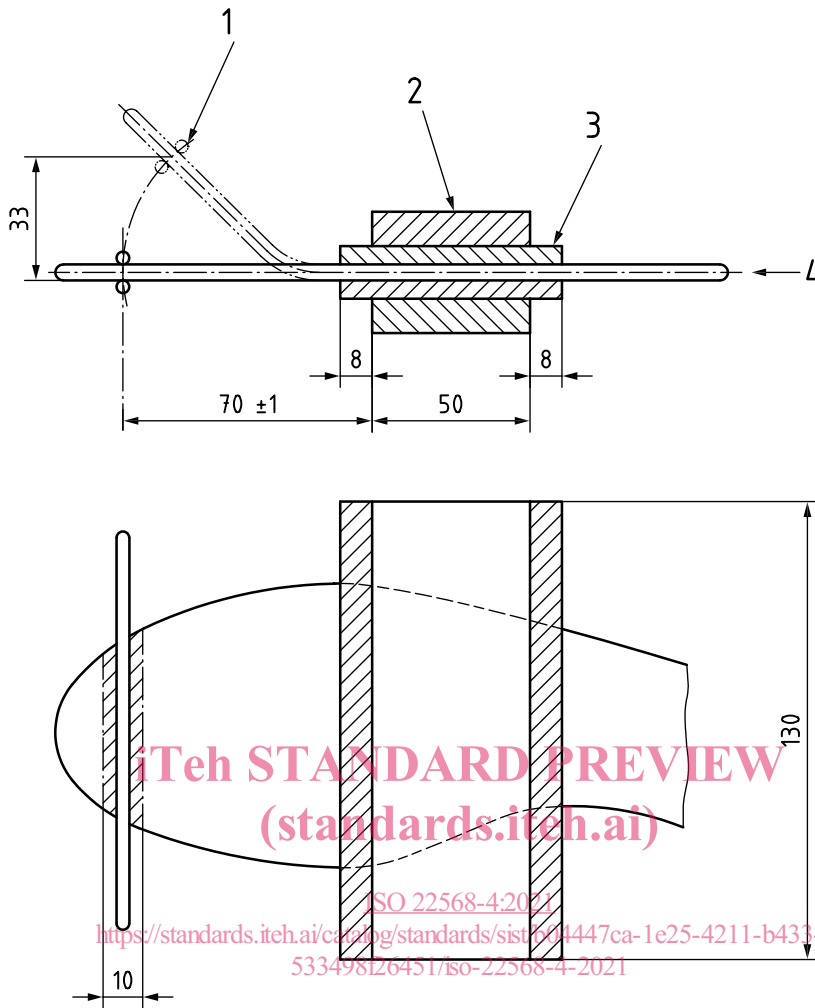
### 5.2 Determination of flexing resistance

#### 5.2.1 Apparatus

Flexing apparatus, comprising a suitable flexing guide (e.g. a pair of bars) to move the free end of the non-metallic perforation resistant insert through a specified distance at a defined rate and a clamping device consisting of two elastic interlayers approximately 4 mm thick and of Shore A hardness  $75 \pm 5$  with two metal clamping plates at least 130 mm wide.

In the zero position, the guide acts at a distance of  $(70 \pm 1)$  mm from the clamping plates (see [Figure 1](#)).

Dimensions in millimetres



**Key**

- |                   |                      |
|-------------------|----------------------|
| 1 flexing guide   | 3 elastic interlayer |
| 2 clamping plates | 4 test piece         |

**Figure 1 — Example of details of a suitable construction of a flexing apparatus for non-metallic perforation resistant inserts**

**5.2.2 Sampling**

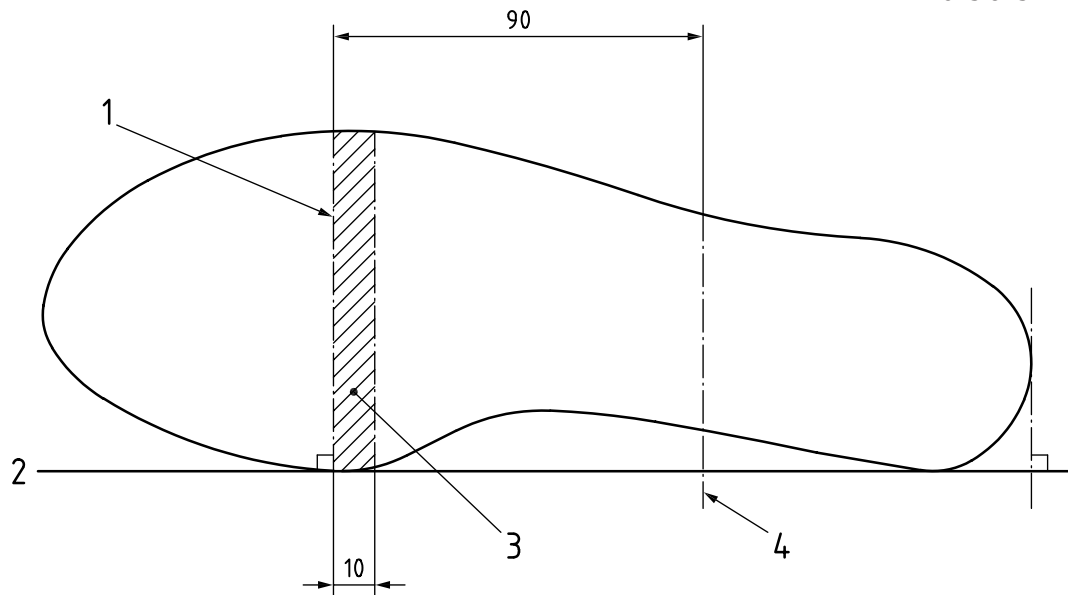
**5.2.2.1 Number of test pieces**

In case of ready-shaped non-metallic perforation resistant inserts, samples of two different sizes shall be tested. For unshaped material cut out two suitable test pieces, giving them a shape similar to a typical insole of approximate size 41 to 42 (Paris Point).

**5.2.2.2 Determination of the flexing line**

Lay the non-metallic perforation resistant insert with its inner edge against a straight base line in such a way that this line is at a tangent to the insert in the joint and heel regions. At the tangent to the joint construct a perpendicular. This line is the flexing line at which the insert is clamped (see [Figure 2](#)).

Dimensions in millimetres

**Key**

- |   |              |   |              |
|---|--------------|---|--------------|
| 1 | flexing line | 3 | flexing zone |
| 2 | base line    | 4 | line of cut  |

**Figure 2 — Flexing line for non-metallic perforation resistant inserts**  
(standards.iteh.ai)

**5.2.2.3 Preparation of test piece**

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If necessary, cut off the heel part of the non-metallic perforation resistant insert at a distance of at least 90 mm from the flexing line (see [Figure 2](#) and [5.2.2.2](#)).

**5.2.3 Test procedure**

Deflect the test piece at a rate of  $(16 \pm 1)$  Hz by moving the guide bar to a height of 33 mm, measured vertically above the zero position. Ensure by means of a guide that the test piece returns to the zero position after every deflection. After  $1 \times 10^6$  flexes, carry out a visual examination of the test piece.

**5.2.4 Results**

For ready-shaped non-metallic perforation resistant inserts, the two results for the two different sizes shall be reported.

In case of unshaped material, the 2 results shall be reported.

**5.2.5 Test report**

The test report shall include the following information:

- a reference to this document, i.e. ISO 22568-4:2021;
- a full description of the samples tested including sizes, commercial styles, codes, colours, nature, etc.;
- the results of the visual examination;
- description of any change of the test piece (for example delamination);
- any deviation by agreement and otherwise from the present test method.